CHUMAKOV, Yu.I.; SHERSTYUK, V.P.; DZYGUN, Ye.P.

Synthesis of mono- and dialkylpyridines substituted in the positions 3,4, and 5. Ukr. khim. zhur. 31 no.6:597-600 '65. (MIRA 18:7)

1. Kiyevskiy politekhnicheskiy institut.

5(4)

AUTHORS: Movchan, B. A., Dzykovich, I. Ya. SOV/20-125-2-32/64

TITLE: On the Selective Penetration of Dissolved Elements From the Liquid Phase Into a Crack (Ob izbiratel'nom proniknovenii rastvorennykh elementov iz zhidkoy fazy v treshchinu)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 2, pp 354-355 (USSR)

ABSTRACT: In the present paper direct determination of the concentration of the liquid enriched in the crack formed on the boundary between the phases is carried out. The experiments were carried out on aluminum-copper- and aluminum-zinc alloys, which had been produced from pure components (99.995 %). Carrying out of experiments is described on the basis of a schematical drawing. The authors operated by means of the quantitative and qualitative absorption-microradiography. The essential feature of microradiography is based on the simultaneous microradioscopy of the sample (small plate) to be investigated and of a pattern on a fine-granular film. The following photometrization of the microradiographic pictures makes it possible to determine the chemical composition of the

Card 1/3

On the Selective Penetration of Dissolved Elements From the Liquid Phase Into a Crack

SOV/20-125-2-32/64

given microstructure. The accuracy of the method of quantitative microradiography is $\pm(10 \pm 15)\%$ of the quantity to be measured. According to the results determined by this method, the copper- and zinc-content in the crack is considerably higher than the average value of this content in the corresponding alloys. A microradiogram of a sample having a crack recorded by means of iron radiation is shown in form of a diagram and the results of the quantitative radiography are given in a table. In the cracks, which are in contact with liquid aluminum-copper alloys with 2 - 9 and 7.8 % copper the copper content is about equal to eutectic concentration. This also agrees well with the results obtained by metallographical analysis. The alloy filling the crack is of eutectic structure. With an increase of the zinc- and copper content in the respective alloys the tendency towards forming surface cracks diminishes. The selective penetration of the dissolved elements into the crack may be explained by a tendency towards establishing an equilibrium between the phases. The copper- and zinc-content in the cracks agrees within the error limits with the concentrations

Card 2/3

On the Selective Penetration of Dissolved Elements From the Liquid Phase Into a Crack SOV/20-125-2-32/64

determined from the liquidus of the diagrams mentioned. There are 2 figures, 1 table, and 9 references, 8 of which are Soviet.

ASSOCIATION: Institut elektrosvarki im. Ye. O. Patona Akademii nauk SSSR (Institute of Electric Welding imeni Ye. O. Paton of the Academy of Sciences, USSR)

PRESENTED: December 7, 1958 by A. A. Bochvar, Academician

SUBMITTED: December 2, 1958

Card 3/3

30226

18.7500
1.2300

S/125/61/000/011/002/012
D040/D113

AUTHOR: Dzykovich, I. Ya.

TITLE: Investigation of the structure and crystallization processes of weld metal on austenitic chrome-nickel steels

PERIODICAL: Avtomaticheskaya svarka, no. 11, 1961, 14-19

TEXT: Data is presented on an investigation of the effect of cooling rate and additional alloying with Mo, Ta, W and Mn on the structure and the crystallization process of Х16Н20 (Kh16N20), Х16Н35 (Kh16N35) and Х20Н80 (Kh20N80) alloys. A special wedge-shaped copper mold with double walls, between which water circulated, was used to imitate the welds. A thermocouple and an oscillograph were used for plotting curves showing the dependence of the cooling rate on the wedge height. The included photo-micrographs show the high effect that the cooling rate has on the dimensions of acicular crystallites. It was stated that polygonization depended on the cooling rate, the content of additional alloying elements and alloy type, e.g. polygonization stopped completely in Kh16N20 and Kh20N80 alloys at a cooling rate of 40-2000°C/sec with 2.5% Mo added to Kh16N20 and 14% to Kh20N80; however, on adding 10% Mo to Kh20N80, polygonization could only be

Card 1/3

prevented by using a cooling rate of 170-200°C/sec. Welds were produced for comparison on Kh16N35 steel using the conventional subarc method. The structure of the welds was improved and hot cracking reduced by feeding neutral wire into the tail portion of the pool. Reference is made to other data, proving that crystal lattice defects in weld metal and cast high alloys may be controlled by varying the cooling rate (Ref. 2: B. A. Movchan, "Avtomaticheskaya svarka", No. 9, 1960; Ref. 3: B. A. Movchan, I. Ya. Dzykovich, "Vozmozhnost' upravleniya raspredeleniyem nesovershenstv kristallicheskoy reshetki v litykh vysokolegirovannykh splavakh". [The possibility of controlling the distribution of crystal lattice defects in cast high alloys], sb. "Nauchnyye doklady po teorii zharoprochnosti", M., 1961). The following conclusions were drawn: (1) The cooling rate in the root of welds on the studied alloys is 3-4 times higher than in the top portion; (2) feeding a separate filler wire into the rear portion of the pool, raises the cooling rate of the weld root from 140 to 190°C/sec, and that of the weld top portion from 30 to 50°C/sec; (3) polygonization stopped in the Kh16N20 cast alloy containing 2.5% Ta, when a cooling rate of 40-200°C/sec was applied; to obtain the same effect with 2.5% additions of Ta, W and Mn,

Card 2/3

Investigation of the structure ...

cooling rates of 40-200°C/sec, 100-200°C/sec and 120-200°C/sec had to be applied. There are 5 figures and 6 Soviet references.

ASSOCIATION: Ordona Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye. O. Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye. O. Paton, AS UkrSSR)

SUBMITTED: March 7, 1961

X

Card 3/3

32958
S/125/62/000/001/003/011
D036/D113

1.2300 1573

AUTHORS: Kushnirenko, B. N.; Dzykovich, I. Ya.

TITLE: Some metallurgical methods of combatting hot cracking in welds on austenitic steels

PERIODICAL: Avtomaticheskaya svarka, no. 1, 1962, 14-19

TEXT: Methods of preventing hot cracking in closed butt welds in nichrome austenitic steels of the 1Х16Н18Т (1Kh16N18T), 1Х16Н24Т (1Kh16N24T) and 1Х18Н9Т (1Kh18N9T) types and in Н1 (N1) commercial nickel, mainly by adding modifiers to the "cold" part of the welding pool are described. The experiments are a continuation of previous studies in which it was demonstrated that the distribution of crystal lattice imperfections could be controlled in cast high alloys. Welding was carried out with 1Х18Н9 (1Kh18N9) 5 mm welding wire and an АН-26 (AN-26) lowsilicon flux at 600-650 amp and 36-40 v, using reversed-polarity direct current and a АТС-24 (DTS-24) two-arc tractor fitted with a device for feeding the filler wire into the "cold" part of the welding pool (fig. 1). Conclusions: (1) Modifying and alloying the weld metal can best be achieved by introducing

Card 1/1 3

Some metallurgical methods of ...

additives in the form of powder or solid filler wire directly into the "cold" part of the welding pool; (2) When the welding pool is cooled by the filler wire, the crystal structure is improved, the size of the acicular crystals is reduced, the polygonization boundaries change, and the number of hot cracks is reduced by 40-60%, even without modifying agents; (3) Modification using cerium with simultaneous cooling of the welding pool, produced the acicular structure and virtually eliminated hot cracking in welding 1Kh16N18T steel; (4) Molybdenum, introduced into welds in 1Kh16N18T and 1Kh16N24T type steels in the critical amounts of 1.6-1.9% and 2.3-2.5% respectively, and in the form of powder wire, suppressed the polygonization process, considerably refined the acicular structure and eliminated hot cracking. Tungsten in critical amounts of 2.6-3.2% had an almost similar effect; (5) A practical method was developed for eliminating cracking in the weld crater. The method uses a modified two-arc welder, and consists in continuing to feed a second wire with the molybdenum into the crater for a certain time after cessation of the feed of the first wire. In addition to these conclusions, it was also found that molybdenum and tungsten in the same amounts as given in (4) eliminated hot cracking in fillet and T-butt welds. The addition of 0.1% of cerium into

Card 2/3

Some metallurgical methods of ...

welds in N1 nickel also eliminated hot cracking, as it removed sulfur from the solid solution, resulted in the formation of fine primary inclusions of the second phase, and retarded the polygonization process. There are 6 figures and 5 Soviet references.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye. O. Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye. O. Paton of the AS UkrSSR)

SUBMITTED: March 29, 1961

Card 3/3

MOVCHAN, B.A.; DZYKOVICH, I.Ya.

Possibility of controlling the distribution of defects in the crystal lattice of high-alloy castings. Issl. po zharopr. splav. 9:243-248 '62. (MIRA 16:6)

(Heat-resistant alloys—Metallography)
(Crystal lattices—Defects)

ACCESSION NR: AT4013928 S/2659/63/010/000/0052/0057

AUTHOR: Movchan, B. A.; Dzy*kovich, I. Ya.; Nerodenko, L. M.

TITLE: A new approach to analysis of the mobility of imperfections in the crystal lattice in alloys

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochny*m splavam, v. 10, 1963, 52-57

TOPIC TAGS: crystal lattice, crystal lattice imperfection, alloy, alloy crystal structure, crystal lattice imperfection mobility

ABSTRACT: High energy nuclear radiation, plastic deformation and rapid cooling of alloys from high temperatures (not exceeding the melting point) often lead to imperfections in the crystal lattice. The most important feature of the proposed approach to the analysis of the mobility of imperfections in solid solutions is the fact that the diffusive motion of the dislocations is considered in continuous connection with the chemical composition and, consequently, with the type of atomic action in the alloys. Data on the mobility of dislocations allow one tojudge the relative mechanical properties of alloys at high temperatures without employing complicated and lengthy tests. The described method of estimating the

Card 1/2

ACCESSION NR: AT4013928

diffusive mobility of dislocations on the basis of a wedge-shaped casting is distinguished by simplicity, rapid analysis and clarity and may be used with success for finding heat resistant alloys on the basis of solid solutions, for selecting satisfactory welding alloys, etc. Orig. art. has: 2 figures and 1 table.

ASSOCIATION: Institut Metallurgii AN SSSR (Metallurgical Institute AN SSSR)

SUBMITTED: 00	DATE ACQ: 27Feb64	ENCL: 00
SUB CODE: ML	NO REF SOV: 005	OTHER: 001

Card 2/2

MOVCHAN, B.A.; DZYKOVICH, I.Ya.

Rapid method of selecting one-phase alloys with satisfactory weldability and heat resistance. Avtom. svar. 16 no.2:34-40 F '63. (MIRA 16:4)

1. Institut elektrosvarki imeni Ye.O.Patona AN UkrSSR.
(Alloys—Metallography) (Welding—Testing)

L 1679-66 EWP(e)/EWT(m)/T/EWP(t)/EWP(k)/EWP(z)/EWP(b)/EWA(c) IJP(c) JD/HW/JG

ACCESSION NR: AP5020772 UR/0226/65/000/008/0062/0069

AUTHOR: Dzykovich, I. Ya.; Makarova, R. V.; Teodorovich, O. K.; Frantsevich, I. N.

TITLE: Distribution of elements in forming metal ceramic alloys of the tungsten-nickel-iron system

SOURCE: Poroshkovaya metallurgiya, no. 8, 1965, 62-69

TOPIC TAGS: metal ceramic material, tungsten base alloy, nickel containing alloy, iron containing alloy, solubility

ABSTRACT: Samples of tunsten-nickel-iron alloys of the following composition were studied: W-10Ni(nickel 9.8%, remainder tungsten); W-7Ni-3Fe (7.2% nickel, 2.95% iron, remainder tungsten), W-5Ni-5Fe (5.0% nickel, 5.15% iron, remainder tungsten), and W-3Ni-7Fe (3.0% nickel, 7.0% iron, remainder tungsten). Powders were prepared from reduced tungsten powder with a grain size of less than 40 microns and an aqueous solution of the nitrogen salts of nickel and iron and were reduced in a hydrogen atmosphere at 450 and 850 C. They were pressed at 20 kn/cm^2 into samples with a diameter of 10 mm and a height of 10 mm and

Card 1/2

L 1679-66

ACCESSION NR: AP5020772

6

sintered in a furnace at 1450 C for 2 hours, with rapid cooling. One face of each sample was polished for examination. Results of experiments show that, in tungsten-nickel iron alloys, the introduction of iron has an effect on the mutual solubility of tungsten and nickel. In alloys containing iron, in comparison with tungsten nickel alloys, there is observed a contraction of the heterodiffusion front. The distribution of iron with respect to the tungsten grain remains constant, independent of the composition of the alloy, and more uniform in spite of the solubility which is five times greater than the solubility of nickel in alloys with an identical ratio of elements. Orig. art. has: 4 figures and 2 tables

ASSOCIATION: Institut elektrosvarki im. E. O. Patona AN USSR (Electric Welding Institute, AN UkrSSR); Institut problem materialovedeniya AN USSR (Institute for Problems of Materials Processing, AN UkrSSR)

SUBMITTED: 06Oct64 ENCL: 00 SUB CODE: MM

NR REF SOV: 003 OTHER: 000

Card 2/2

VOLOSHCHENKO, M.V., kand. tekhn. nauk; DZYKOVICH, I.Ya., kand. tekhn. nauk

Distribution of silicon and magnesium in cast iron. Lit. proizv. no.9: 7-9 S '65. (MIRA 18:10)

DZYKOVICH, I.Ya.; MAKAROVA, R.V.; TEODOROVICH, O.K.; FRANTSEVICH, I.N.

Distribution of elements during the formation of ceramic metal alloys in the system W - Ni - Fe. Porosh. met. 5 no.8:62-69 Ag '65. (MIRA 18:9)

1. Institut elektrosvarki imeni Patona AN UkrSSR i Institut problem materialovedeniya AN UkrSSR.

FEDORCHENKO, I.M.; PANAIOTI, I.I.; DERKACHEVA, G.M.; DZYKOVICH, I.Ya.; GORDAN', G.N.

Studies in the field of friction materials. Report No.2. Poroshk. met. 5 no.9:65-68 S '65. (MIRA 18:9)

1. Institut problem materialovedeniya AN UkrSSR i Institut elektrosvarki imeni Patona AN UkrSSR.

MAKARA, A.M.; DZYKOVICH, I.Ya.; MOSENDZ, N.A.; GORDAN', G.N.

Investigating the microscopic chemical heterogeneity in welds. Avtom.svar. 18 no.11:5-11 N '65. (MIRA 18:12)

1. Institut elektrosvarki im. Ye.O.Patona AN UkrSSR.
Submitted April 13, 1965.

L 24457-66 EWT(m)/EWP(v)/T/EWP(t)/EWP(k) IJP(c) JD/HM/WW/JG
ACC NR: AP6012277 (N) SOURCE CODE: UR/0125/65/000/011/0005/0011

55
47
B

AUTHOR: Makara, A. M.; Dzykovich, I. Ya.; Mosendz, N. A.; Gordan', G. N.

ORG: Institute of Electric Welding im. Ye. O. Paton, AN UkrSSR (Institut elektrosvarki AN UkrSSR)

TITLE: Investigation of microscopic chemical heterogeneity in weld joints

SOURCE: Avtomaticheskaya svarka, no. 11, 1965, 5-11

18 18

TOPIC TAGS: welding, x ray analysis, alloy steel, weld evaluation, cooling rate, high strength steel, seam welding

ABSTRACT: Localized x-ray analysis is used for studying the effect of cooling rate on the degree of chemical nonhomogeneity in welded seams of high-strength steel as a function of the content of basic alloying elements (silicon, manganese, chromium, nickel, molybdenum and tungsten) and also for determining the relationship between this nonhomogeneity and the concentration of carbon in the seam, as well as the content of carbon combined with alloying elements. Electroslag, electric arc and electron beam methods were used to give a wide range of cooling rates. Welded specimens of KhGSN, Kh2GSNVM and Kh3M were studied. It is shown that the degree of microscopic chemical heterogeneity in the joints remains nearly constant throughout a wide range of cooling rates and variations in acicular crystallite sizes. The degree of liquation of

UDC: 621.791.053 : 620.192.3

Card 1/2

L 24457-66

ACC NR: AP6012277 8

elements in the weld seams is considerably dependent on carbon concentration, nature of the impurity element and the system used for alloying. The degree of molybdenum liquation increases rapidly with carbon concentration, tungsten shows somewhat less dependence, while the liquation of chromium, silicon, manganese, and nickel is affected only slightly by an increase in carbon content. Molybdenum and vanadium liquate out much more readily than chromium, silicon and manganese; nickel is not segregated in this manner at all in many cases. Further studies are needed on the development of chemical microheterogeneity in weld seams as a function of crystallization conditions, concentration and nature of impurity elements and alloying systems. Orig. art. has: 3 figures, 3 tables.

SUB CODE: 11,13/ SUBM DATE: 13Apr65/ ORIG REF: 008/ OTH REF: 002

Card 2/2 dda

L 23416-66 EWT(m)/EWP(w)/EWA(d)/EWP(v)/T/EWP(t)/EWP(k) IJP(c) JD/HM/JH

ACC NR: AP6004135 (N) SOURCE CODE: UR/0125/66/000/001/0010/0014

AUTHOR: Rabkin, D. M.; Dzykovich, I. Ya.; Ryabov, V. R.; Gordan', G. N.

ORG: Institute of Electric Welding im. Ye. O. Paton, AS UkrSSR (Institut elektrosvarki)

TITLE: Distribution of elements in the fusion zone during the welding of aluminum with steel

SOURCE: Avtomaticheskaya svarka, no. 1, 1966, 10-14

TOPIC TAGS: arc welding, bimetal welding, aluminum, steel, phase composition

ABSTRACT: This distribution was investigated by means of microradiographic and x-ray structural analyses for cases of different pre-welding treatment of both metals. Three types of steel-aluminum welded specimens cut out from the zone of transition from Al to steel were investigated: zinc-plated steel St. 3 (thickness of galvanic coating ~40 μ with aluminum AD1 (automatic double-arc welding); steel St. 3 with the Al alloy AMg5V (automatic argon arc welding, coated wire electrodes containing pure aluminum AV000 treated with 2 and 5% Si); alitized steel 1Kh18N9T with the alloy AMg6 (alitizing performed in pure aluminum AV000, with subsequent argon arc welding with standard coated AMg6 wire). Findings: the welding of zinc-plated steel St. 3 with aluminum AD1 results in a fusion zone containing 38-43% Fe. The constitution diagram

Card 1/2 UDC: 621.791.7:546.621:669.140

L 23416-66

ACC NR: AP6004135

shows that this corresponds to the presence of two phases in the layer: Fe_2Al_3, located more closely toward iron, and $FeAl_3$, located more closely toward Al. Welding with Si-treated coated wire electrode changes the phase composition of the fusion zone compared with the fusion zone of Zn-treated Fe-Al welds: the amount of the Fe_2Al_5 phase decreases and the width of the intermetallide layer is insignificant. Thus, silicon participates in the formation of the fusion zone by narrowing the region of existence of the most brittle phase Fe_2AL_5. As for the fusion zone of the welded joint of alitized -- in pure Al -- steel 1Kh18N9T with Al alloy AMg6, it was found to contain a lower (~24-25%) amount of Fe, which accounts for the particularly high strength of this type of welded joint. Orig. art. has: 2 formulas, 6 figures.

SUB CODE: 11, 13, 20/ SUBM DATE: 12Feb65/ ORIG REF: 007/ OTH REF: 005

Card 2/2

L 47446-66 EWT(d)/EWT(m)/EWP(w)/EWP(v)/T/EWP(t)/ETI/EWP(k) [illegible] JD/HM/HW/
ACC NR: AP6007108 (N) JG/WB/EM SOURCE CODE: UR/0129/66/000/002/0033/0038

AUTHORS: Kakhovskiy, N. I.; Yushchenko, K. A.; Dzykovich, I. Ya.; Yushkevich, Z. V. 62

ORG: Institute for Electro-Welding imeni Ye. O. Paton, AN UkrSSR (Institut elektrosvarki AN UkrSSR)

TITLE: Corrosion properties of welded joints of steel OKh21N6M2T

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 2, 1966, 33-38

TOPIC TAGS: alloy steel, welding, seam welding, corrosion, sulfuric acid, formic acid, phosphoric acid / OKh21N6M2T alloy steel

ABSTRACT: The corrosion stability of welded steel OKh21N6M2T joints in sulfuric, formic, and phosphoric acid at 40--70C was investigated. The investigation was carried out by x-ray and microstructural analysis. The experimental results are presented graphically. In addition, the element distribution in the α and γ phases was studied. The composition of the phases was determined by the microanalyzer of Kamek. It was found that in hot concentrated corrosive media a structure-selective corrosion of the metal occurs. The amount of Ni and Mo in the α and γ phases depends on the overall nickel content of the steel. Orig. art. has: 3 tables and 2 graphs.

SUB CODE: 11, 13/ SUBM DATE: none/ ORIG REF: 005/ OTH REF: 001
UDC: 620.193.41:669:14.018.8:621.791

Card 1/1

L 07434-67 EWT(m)/EWP(t)/ETI IJP(c) JH/JD/HW

ACC NR: AP6030266 (N) SOURCE CODE: UR/0125/66/000/008/0006/0009

47
B

AUTHOR: Makara, A. M.; Dzykovich, I. Ya.; Gordan', G. N.; Mosendz, N. A.

ORG: Institute of Electric Welding im. Ye. O. Paton, AN UkrSSR (Institut elektrosvarki AN UkrSSR)

TITLE: Chemical micrononhomogeniety of cast alloys as a function of cooling rate

SOURCE: Avtomaticheskaya svarka, no. 8, 1966, 6-9

TOPIC TAGS: cast alloy, aluminum base alloy, copper base alloy, zinc containing alloy, nickel containing alloy, cooling rate, metal crystallization

ABSTRACT: Local x-ray spectral analysis is used for studying the effect of cooling rate on the degree of liquation of alloying elements in aluminum-zinc (15 wt.% Zn) and copper-nickel (15 wt.% Ni) alloys. The alloys were melted from 99.99% pure components in alundum and steel crucibles 20 mm in diameter and 30 mm high. The difference in cooling rates was produced by using cold water, air or by furnace cooling. Some of the copper-nickel alloys were also poured into tapered water-cooled molds to obtain intermediate cooling rates. The cooling curves showed a pronounced inflection point corresponding as a rule to the equilibrium liquidus temperature. This temperature was taken as the end of crystallization on curves where this point was not fixed. The experimental data show that the degree of liquation of zinc in the Al-Zn alloys and of

Card 1/2 UDC: 621.791;620.192.4

L 07434-67

ACC NR: AP6030266 O

nickel in the Cu-Ni alloys increases sharply as the cooling rate is accelerated reaching a maximum at comparatively low cooling rates (about 1-3°C/sec) where it remains constant with a further increase in cooling rate. The development of chemical micrononhomogeniety (dendrite liquation) during crystallization changes the composition of interdendrite boundaries and the temperature range of alloy crystallization. This should have a corresponding effect on the technological properties of the alloy in this range. These data may be used for explaining the connection between the type of phase diagram and the resistance of the alloy to the formation of hot cracks. The composition of the dendrite axes in aluminum-zinc alloy is determined by the equilibrium solidus point and is independent of cooling rate over a wide range. Orig. art. has: 4 figures, 1 table.

SUB CODE: 11/ SUBM DATE: 16Mar66/ ORIG REF: 014/ OTH REF: 002

Card 2/2

L 04660-67 EWP(k)/EWT(m)/T/EWP(v)/EWP(t)/ETI IJP(c) JD/JW

ACC NR: AP6014439 SOURCE CODE: UR/0125/65/000/012/0040/0045

AUTHORS: Grabin, V. F.; Dzykovich, I. Ya.; Kushnirenko, N. A.; Zamkov, V. N.

ORG: Institute for Electro-Welding imeni Ye. O. Paton, AN UkrSSR (Institut elektrosvarki AN UkrSSR)

TITLE: The formation of $TiCr_2$ in welded joints of titanium alloy containing the unstable β-phase

SOURCE: Avtomaticheskaya svarka, no. 12, 1965, 40-45

TOPIC TAGS: titanium alloy, chromium containing alloy, molybdenum containing alloy, aluminum containing alloy, welding technology, welding inspection, seam welding / VT15 titanium alloy

ABSTRACT: The formation, distribution, and effect on the weld properties of $TiCr_2$ formed during welding of alloy VT15 was investigated. The investigation was carried out by metallographic and electron microscope techniques. The distribution of α- and β-phase stabilizing alloying elements was also studied. This study was carried out with the aid of microsonde "Kameka" as described by R. Castaing (Application des sondes électroniques à une methode d'analyse ponctuelle chimique et cristallographique, Thesis, Univ. Paris, ONERA, Publ. N. 55, 1951). The experimental results are summarized in graphs and tables (see Fig. 1). It was established

UDC: 621.791.7:546.821

Card 1/3

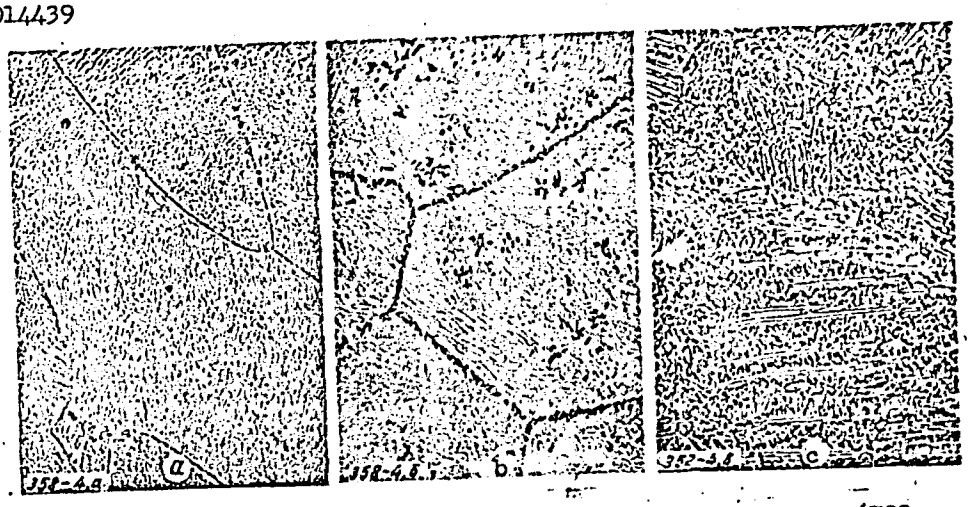


Fig. 1. Metal structure in the seam after isothermal annealing up to 670C for different time periods (x 250). a - 24 hours; b - 1500 hours, electropolished; c - 1500 hours, etched.

that $TiCr_2$ is indeed present in welding seams of alloy VT15. To insure high impact strength of the seam, the latter must be quenched from a higher temperature than the base metal. The separation of $TiCr_2$ along grain boundaries is accompanied by a

ACC NR: AP6014439

redistribution of the alloying elements--chromium, molybdenum, and aluminum. Orig. art. has: 3 tables and 6 graphs.

SUB CODE: 11/ 13/ SUBM DATE: 09Mar65/ ORIG REF: 004/ OTH REF: 009

Card 3/3

KOSTRIKIN, Yu.M., kand.tekhn.nauk; DZYSYUK, A.A., inzh.; KLIMOV, B.Ya., inzh.; SHITIKOVA, G.V., inzh.

Testing of the mixers of a uniflow water coagulation system. Teploenergetika 8 no.11:59-61 N '61. (MIRA 14:10)

1. Vsesoyuznyy teplotekhnicheskiy institut i Leningradskaya elektroenergeticheskaya sistema.
(Feed-water purification)

BRYUKHOVETSKIY, V.D., inzh.; GORMAN, I.N., inzh.; DZYSYUK, A.A., inzh.; DRUSHLYAK, V.M., inzh.

Removal of iron from industrial condensate by means of filtration through a cellulose layer. Elek. sta. 32 no.12:61 D '61. (MIRA 15:1)

(Feed-water purification)

DZYSYUK, A.A., inzh.; KALININA, N.M., tekhnik; KOSTRIKIN, Yu.M., kand. tekhn. nauk.; PETROVA, S.Yu., tekhnik; RUMYANTSEVA, V.A., inzh.; TOBOLEVA, A.D., tekhnik; SHTERN, O.M., inzh.; SHCHERBINA, S.D., inzh.

New chemical water analysis techniques. Elek. sta. 35 no.7:31-34 Jl '64. (MIRA 17:11)

31508 S/056/60/039/003/011/045
B102/B201

24,7000 (1144, 1385, 1559, 1143)

AUTHOR: Dzyub, I. P.

TITLE: Theory of exciton states in semiconductors

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 39, no. 3 (9), 1960, 610-615

TEXT: A study of exciton states in a semiconductor allows a number of conclusions to be drawn regarding the electron band spectrum. Experiments have repeatedly proved that the electron energy spectrum in the region of the bottom of the conduction band has an exciton structure. Studies of photoeffects and theoretical studies have also confirmed the existence of excitons. It is shown here that the method of Green functions makes it possible to consider the problems related to excitons in semiconductors from a uniform point of view. Compared with other methods, the one mentioned above has the advantage of being usable, at any temperature; such problems as exciton energy spectrum, light absorption, dielectric constant, diffusion and heat conduction coefficients, are properly dealt with using the two-particle Green function. The present paper is, however, restricted to the

Card 1/10

problem of an exciton in an undeformed lattice. A system of valence electrons in a crystal lattice is considered, whose nodes are allowed to be at rest. The system of valence electrons can be generally described by the Hamiltonian

$$H = \sum_{f_1 f_2} L(f_1 f_2) a^+_{f_1} a^+_{f_2} + \frac{1}{2} \sum_{f_1 f_2 f_3 f_4} F(f_1 f_2 f_3 f_4) a^+_{f_1} a^+_{f_2} a_{f_3} a_{f_4}, \quad (1),$$

which takes account of the interaction of electrons with the lattice nodes and amongst one another. The subscript of f determines the coordinates of the lattice point and the state of the electron in it. The electron band spectrum can be determined from (1) in self-consistent field approximation. The problem consists in taking account of the correlation effects in the electron system, which considerably influence the character of the energy spectrum near the bottom of the conduction band. These correlation effects are studied by using the two-particle (two-time) retarded and advanced Green functions according to N. N. Bogolyubov and S. V. Tyablikov (DAN SSSR, 126, 53, 1959), the equations where $\langle \ldots \rangle = Q^{-1} \mathrm{Sp}(\ldots e^{-H/\theta})$, $Q = \mathrm{Sp}\, e^{-H/\theta}$. The majority of the physical quantities can be calculated by the two-time correlation function $\langle a^+_{f'}(\tau) a_{f''}(\tau) a^+_{g'}(\tau') a_{g''}(\tau') \rangle$. The

Theory of ...

Fourier transformers of (2) and (3) coincide. These transformers are easily obtained when using the equation of motion for the operators in Heisenberg's representation. After several operations one obtains

$$E\langle\langle a_{f'}^{+}a_{f''} \mid a_{g'}^{+}a_{g''}\rangle\rangle = \langle a_{g'}^{+}a_{f''}\rangle \delta_{g''f'} - \langle a_{f'}^{+}a_{g''}\rangle \delta_{g'f''} +$$
$$+\sum_{f} L_{eff}(ff')\langle\langle a_{f}^{+}a_{f''} \mid a_{g'}^{+}a_{g''}\rangle\rangle - \sum_{f} L_{eff}(f''f)\langle\langle a_{f'}^{+}a_{f} \mid a_{g'}^{+}a_{g''}\rangle\rangle +$$
$$+\sum_{f_1f_2f} (F(ff_1f'f_2) - F(ff_1f_2f'))\langle a_{f}^{+}a_{f''}\rangle\langle\langle a_{f_1}^{+}a_{f_2} \mid a_{g'}^{+}a_{g''}\rangle\rangle -$$
$$-\sum_{f_1f_2f} (F(f''f_1ff_2) - F(f''f_1f_2f))\langle a_{f'}^{+}a_{f}\rangle\langle\langle a_{f_1}^{+}a_{f_2} \mid a_{g'}^{+}a_{g''}\rangle\rangle; \qquad (4)$$
$$L_{eff}(f_1f_2) = L(f_1f_2) + \sum_{f'f''} (F(f_1f'f_2f'') - F(f_1f'f''f_2))\langle a_{f'}^{+}a_{f''}\rangle.$$

to derive it, the author used approximation

Card 3/10

$$\langle\langle a^+_{f_1}a^+_{f_2}a_{f_3}a_{f_4}|\,a^+_{g'}a_{g''}\rangle\rangle = \langle a^+_{f_2}a_{f_4}\rangle\langle\langle a^+_{f_1}a_{f_3}|\,a^+_{g'}a_{g''}\rangle\rangle - \langle a^+_{f_1}a_{f_4}\rangle\langle\langle a^+_{f_2}a_{f_3}|\,a^+_{g'}a_{g''}\rangle\rangle + \\ + \langle a^+_{f_1}a_{f_3}\rangle\langle\langle a^+_{f_2}a_{f_4}|\,a^+_{g'}a_{g''}\rangle\rangle - \langle a^+_{f_2}a_{f_3}\rangle\langle\langle a^+_{f_1}a_{f_4}|\,a^+_{g'}a_{g''}\rangle\rangle. \qquad (5)$$

for the three-particle Green function. In terms of physics, this means taking into account the interaction of the excited electron with a hole formed in the background of filled single-electron states. The solution of (4) reads

$$\langle\langle a^+_{f'}a_{f''}|\,a^+_{g'}a_{g''}\rangle\rangle = \sum_{\alpha\alpha'}(E-E_\alpha)^{-1}c_{\alpha\alpha'}u_\alpha(f'f'')\,u^*_{\alpha'}(g'g''), \qquad (7)$$

$$c_{\alpha\alpha'} = \sum_{g_1g_2f_1f_2}\{\langle a^+_{g_1}a_{f_1}\rangle\delta_{g_2f_2} - \langle a^+_{f_1}a_{g_2}\rangle\delta_{g_1f_2}\}\,u^*_\alpha(f_1f_2)\,u_{\alpha'}(g_1g_2).$$

with the normalization condition $\sum_{f'f''} u_\gamma(f'f'')u^*_{\gamma'}(f'f'') = \delta_{\gamma\gamma'}$. This result allows the conclusion that in the electron system collective oscillations (i.e., excitons) are possible, the spectrum of which is determined by the eigenvalues of

Theory of ...

$$E_\nu u_\nu(f'f'') = \sum_f L_{eff}(ff')\,u_\nu(ff'') - \sum_f L_{eff}(f''f)\,u_\nu(f'f) + \\ + \sum_{f_1 f_2 f} \{(F(ff_1f'f_2) - F(ff_1f_2f''))\langle a_f^+ a_{f'}\rangle - \\ - (F(f''f_1ff_2) - F(f''f_1f_2f))\langle a_f^+ a_f\rangle\}\,u_\nu(f_1f_2), \qquad (6).$$

The Green function (7) thus has a pole on the real axis. The eigenvalues of (6) depend on temperature through the mean value $\langle a^+_{f_1} a_{f_2}\rangle$. Two concrete cases are considered, namely, the Frenkel' exciton and the Mott exciton. For the first case, the electron is assumed to be in the ground state $0\vec{g}$ and in the excited state $1\vec{g}$ at the same lattice site $\vec{g}$; the degeneracy of the latter state is neglected. Instead of (6) one thus obtains

$$E_\nu u_\nu(1g, 0g) = (L_{eff}(1g, 1g) - L_{eff}(0g, 0g))\,u_\nu(1g, 0g) + \\ + \sum_{g', g'', \nu=0,1} \{[F(\nu g'', 1g'; 1g, 0g') - F(\nu g'', 1g'; 0g', 1g)]\langle a^+_{\nu g''} a_{0g'}\rangle - \\ - [F(0g, 1g'; \nu g'', 0g') - F(0g, 1g'; 0g', \nu g'')]\langle a^+_{1g''} a_{\nu g''}\rangle\}\,u_\nu(1g', 0g') + \\ + \sum_{g', g'', \nu=0,1} \{[F(\nu g'', 0g'; 1g, 1g') - F(\nu g'', 0g'; 1g', 1g)]\langle a^+_{\nu g''} a_{0g'}\rangle - \\ - [F(0g, 0g'; \nu g'', 1g') - F(0g, 0g'; 1g'; \nu g'')]\langle a^+_{\nu g''} a_{\nu g'}\rangle\}\,u_\nu(0g', 1g'). \qquad (8)$$

Card 5/10

and, for the exciton energy spectrum,

$E_\gamma = E(\vec{k}) = \left\{ \left| \Delta E + \tilde{F}_1(\vec{k}) \right|^2 - \left| \tilde{F}_2(\vec{k}) \right|^2 \right\}^{1/2}$ (9), where

$\Delta E = L_{eff}(1\vec{g}, 1\vec{g}) - L_{eff}(0\vec{g}, 0\vec{g})$ describes the width of the energy gap, $\tilde{F}_1(\vec{k})$ and $\tilde{F}_2(\vec{k})$ are the Fourier transforms of the functions

$$F_1(|\vec{g} - \vec{g}'|) = (n_o - n_1)F(1\vec{g}, 0\vec{g}'; 0\vec{g}, 1\vec{g}'),$$
$$F_2(|\vec{g} - \vec{g}'|) = (n_o - n_1)F(1\vec{g}, 1\vec{g}'; 0\vec{g}, 0\vec{g}'),$$

$$n_o = \langle a^+_{0\vec{g}} a_{0\vec{g}} \rangle, \quad n_1 = \langle a^+_{1\vec{g}} a_{1\vec{g}} \rangle .$$

In the second case (Mott exciton), these excitons being in the ground state

Card 6/10

at the site $\vec{g}$ is assumed to be in the excited state at the site $\vec{h}$. Then, the equation

$$E_\gamma u_\gamma(1h,\ 0g) = \sum_{h'} L_{ell}(1h',\ 1h)\, u_\gamma(1h',\ 0g) -$$

$$- \sum_{g'} L_{ell}(0g,\ 0g')\, u_\gamma(1h,\ 0g') +$$

$$+ \sum_{g',\ h',\ \sigma=0g'',\ 1h''} \{[F(\sigma,\ 1h';\ 1h,\ 0g') - F(\sigma,\ 1h';\ 0g',\ 1h)]\langle a_\sigma^+ a_{0g}\rangle - \quad (10)$$

$$- [F(0g,\ 1h';\ \sigma,\ 0g') - F(0g,\ 1h';\ 0g',\ \sigma)]\langle a_{1h}^+ a_\sigma\rangle\}\, u_\gamma(1h',\ 0g') +$$

$$+ \sum_{g',\ h',\ \sigma=0g'',\ 1h''} \{[F(\sigma,\ 0g',\ 1h,\ 1h') - F(\sigma,\ 0g';\ 1h',\ 1h)]\langle a_\sigma^+ a_{0g}\rangle -$$

$$- [F(0g,\ 0g';\ \sigma,\ 1h') - F(0g,\ 0g';\ 1h',\ \sigma)]\langle a_{1h}^+ a_\sigma\rangle\}\, u_\gamma(0g',\ 1h').$$

is obtained instead of (5); the equation for $u_\gamma(0\vec{g},\ 1\vec{h})$ is analogous. When leaving only the two-center integrals of (10), then

Theory of ...

$$E_\gamma u_\gamma(1\mathrm{h},\ 0\mathrm{g}) = \sum_{\mathrm{h}'} L_{eff}(1\mathrm{h}';\ 1\mathrm{h})\, u\ (1\mathrm{h}',\ 0\mathrm{g}) -$$

$$-\sum_{\mathrm{g}'} L_{eff}(0\mathrm{g},\ 0\mathrm{g}')\, u_\gamma(1\mathrm{h},\ 0\mathrm{g}') + [F(0\mathrm{g},\ 1\mathrm{h};\ 1\mathrm{h},\ 0\mathrm{g}) - \qquad (11).$$

$$- F(0\mathrm{g},\ 1\mathrm{h};\ 0\mathrm{g},\ 1\mathrm{h})](n_0 - n_1)\, u_\gamma(1\mathrm{h},\ 0\mathrm{g}),$$

$$n_0 = \langle a^+_{0\mathrm{g}} a_{0\mathrm{g}} \rangle, \qquad n_1 = \langle a^+_{1\mathrm{h}} a_{1\mathrm{h}} \rangle.$$

In this approximation, the equations for the functions $u_\gamma(1\vec{h},\ 0\vec{c})$ and $v_\gamma(0\vec{c},\ 1\vec{h})$ are not interrelated. For excitons with a large radius, the difference equation (11) can be replaced by a differential equation. In momentum representation, one obtains for the function $\bar{u}_\gamma$:

$$E_\gamma \overline{u_\gamma}(\mathrm{p}) = (\varepsilon^{(1)}(\mathrm{p} - \beta\mathrm{k}) - \varepsilon^{(0)}(\mathrm{p} + \alpha\mathrm{k}))\, \overline{u_\gamma}(\mathrm{p}) - \sum_{\mathrm{p}'} \bar{V}(\mathrm{p} - \mathrm{p}')\overline{u_\gamma}(\mathrm{p}'), \qquad (12);$$

the dispersion law for the electron in the conduction band and in the

Card 8/10

Theory of ...

valence band, respectively read:

$$s^{(1)}(p) = \sum_{h-h'} L_{eff}(1h, 1h') e^{-ip(h-h')},$$

$$s^{(0)}(p) = \sum_{g-g'} L_{eff}(0g, 0g') e^{-ip(g-g')}.$$

(12) in coordinate representation reads:

$$E_\gamma \overline{u_\gamma}(r) = \left[\Delta E + \frac{k^2}{2(\mu_o + \mu_1)} - \frac{\hbar^2}{2\mu}\Delta_r\right]\overline{u_\gamma}(r) - V(r)\overline{u_\gamma}(r)$$

where $\alpha = \mu_o/\mu_o + \mu_1$, $\beta = \mu_1/(\mu_o + \mu_1)$, μ_i are the effective masses, μ is the reduced mass, and ΔE is the energy gap. Thus, one has an equation that describes the discrete structure of the exciton spectrum. N. N. Bogolyubov, S. V. Tyablikov, and D. N. Zubarev are thanked for advice and discussions. There are 30 references: 15 Soviet-bloc and 15 non-Soviet-bloc. The three most recent references to English-language publications read as follows: S. Zwerdling, B. Lax et al. Phys. Rev. 114, 80, 1959; C. Horie, Progr. Theor.

Card 9/10

31508
S/056/60/039/003/011/045
B102/B201

Theory of ...

Phys. 21, 113, 1959; J. J. Hopfield, Phys. Rev. 112, 1555, 1958.

ASSOCIATION: Matematicheskiy institut Akademii nauk SSSR (Institute of Mathematics, Academy of Sciences USSR)

SUBMITTED: March 12, 1960

Card 10/10

24.7700
24.7100
~~9 (3), 24 (5)~~

67889

S/020/60/130/06/017/059
B013/B007

AUTHOR: Dzyub, I. P.

TITLE: The Application of the Method of Green Functions in the Theory of Solids

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 130, Nr 6, pp 1241 - 1243 (USSR)

ABSTRACT: In the present paper the so-called exiton state in crystals is investigated with the aid of Green functions. N. N. Bogolyubov and S. V. Tyablikov (Ref 9) in recent times suggested an easy method of investigating problems of statistical physics by means of advanced and retarded Green functions. The present paper also bases on the aforementioned earlier papers by Bogolyubov and Tyablikov. By the method of Green functions it is possible to deal with the case $T \neq 0^{\circ}$ K and to estimate the order of approximation. If interaction of electrons with the lattice is taken into account according to this method, it is possible immediately to determine some kinetic coefficients relating to the exiton states. For the purpose of determining the spectrum of exiton states, the two-particle- (and the double-timed) Green function is determined. By means of the approximation

Card 1/3

The Application of the Method of Green Functions in the Theory of Solids

S/020/60/130/06/017/059
B013/B007

used here, it is possible to determine the energy spectrum, but not the width of the exiton levels. The author investigates a system of electrons in a lattice. In the most general of cases, this system of electrons is determined by the Hamiltonian $H = \sum_{f_1 f_2} L(f_1 f_2) a^+_{f_1} a_{f_2} + \frac{1}{2} \sum_{f_1 f_2 f_3 f_4} F(f_1 f_2 f_4 f_3) a^+_{f_1} a^+_{f_2} a_{f_3} a_{f_4}$. The index f here denotes the number of the node and the state of the electron on this lattice point. In an atomic semiconductor (of the Ge-type) the index f includes the number of the lattice point and the number of the zone. The problem consists in taking the correlation between the electrons which determines the character of the spectrum of the system of electrons near the bottom of the conduction band into account. For consideration of the electron correlation, investigation of the two-particle Green function suffices. Next, the Fourier-representation of this Green function and the splitting of the three-particle Green function is written down. In order to be able to solve the equation for the above-mentioned Fourier-representation, an

The Application of the Method of Green Functions in the Theory of Solids

S/020/60/130/06/017/059
B013/B007

auxiliary problem is investigated. In the system under investigation elementary excitations are possible, the spectra of which are determined by means of the eigenvalues of an equation written down here. These excitations, by the way, belong (by approximation) to the Bose-type. In the approximation of strong coupling the just mentioned equation for the spectrum of a Frenkel-exiton certainly holds for the electrons in a lattice. If the excited electron passes over to neighboring lattice points, the eigenvalues of this equation are discrete. In an electron gas with Coulomb interaction the above equation determines the spectrum of collective excitations. With $T = 0^{\circ}K$, this spectrum agrees especially with a spectrum determined by K. Sawada (Ref 6). The author thanks N. N. Bogolyubov, S. V. Tyablikov, and D. N. Zubarev for advice and for their interest in the present investigation. There are 14 references, 6 of which are Soviet.

PRESENTED: November 12, 1959, by N. N. Bogolyubov, Academician

SUBMITTED: October 22, 1959

Card 3/3

32073
S/181/61/003/012/007/028
B102/B108

24,3500 (1137, 1138)

AUTHORS: Dzyub, I. P., and Lubchenko, A. F.

TITLE: Resonance scattering of light from impurity centers in a solid

PERIODICAL: Fizika tverdogo tela, v. 3, no. 12, 1961, 3602 - 3613

4

TEXT: A theory of resonance scattering by impurities is developed. The shapes of the excitation and resonance luminescence spectra, their temperature dependence and other solid-state characteristics are studied. The theory is based on the following assumptions: The solid is considered a dielectric solvent containing impurities in such a low concentration that interaction between impurity centers may be neglected. An arbitrary dispersion law is valid. The system consists of the "solid solution" and the radiation field, the absorption range of the solid being far from the impurity absorption range. The excited impurity level l_1 be not degenerate, and far from the other electron levels, which are neglected. Resonance scattering of light, owing to the perturbation H' is described by

Card 1/7

Resonance scattering of...

$l_0(n_s^0)(N_\sigma) \to l_1(n_s)(N_{\sigma'}-1) \to l_0(n_s')(N_{\sigma'}-1, N_{\sigma''}+1)$, where l_0 denotes all the quantum numbers of the ground states of optical impurity electrons. If this sequence of transitions is characterized by 0, 1, 0', the transition probability amplitudes b_0, b_1, and $b_{0'}$ are given by

$$\left.\begin{aligned} b_0 &= \exp\left\{-\frac{\Gamma t}{2}\right\}, \\ b_1 &= c_{n_s}\left[\exp\left\{-\frac{\Gamma t}{2}+\frac{it}{\hbar}(E_1-E_0)\right\}-\exp\left\{-\frac{\gamma_1 t}{2}\right\}\right] \end{aligned}\right\} \quad (4)$$

with

$$\gamma_1 = \frac{2\pi}{\hbar^2}\overline{|\langle l_1|H'_{\sigma''}|l_0\rangle|^2}\rho(\Omega_{l_1 l_0}), \quad (5)$$

$$c_{n_s} = \frac{\langle 1|H'_{\sigma'}|0\rangle}{E_0-E_1+i\hbar\frac{\gamma_1-\Gamma}{2}}. \quad (6)$$

The initial conditions are $b_i(0) = \delta_{i0}$, $i = 0, 1, 0'$. $\hbar\Omega_{l_1 l_0} = E_{l_1(0)(0)} - E_{l_0(0)(0)}$, $\rho(\Omega_{l_1 l_0})$ is the density of the radiation oscillators of the

Card 2/7

Resonance scattering of...

frequency $\Omega_{l_1 l_0}$. $\overline{|\langle l_1|H'_{\sigma''}|l_0\rangle|^2}$ is the result of an integration of the square matrix element of H' with respect to ψ_{p_1} over the solid angle and summation over the polarizations of the scattered quanta. The expression

$$W(\omega_{\sigma'}, \omega_{\sigma''}) = \frac{2M}{\Gamma\hbar^2}\int_0^\infty\int dtdt' e^{i((i'-i)\beta - \frac{\Gamma}{2}(t+t')+g^*(t')+g^*(t)} \mathrm{Re}_\mu \int_0^\infty d\mu e^{-i\mu\varepsilon_0 + K(tt'\mu)}. \quad (10)$$

with

$$\varepsilon_0 = \omega_{\sigma''} - \omega_{\sigma'},\ \beta = -\Omega_{l_1 l_0} + \omega_{\sigma''},\ M = |\langle l_0|H'_{\sigma'}|l_1\rangle|^2 |\langle l_0|H'_{\sigma''}|l_1\rangle|^2,$$

$$K(tt'\mu) = \sum_s \xi^2_{sl_1}[(n_s+1)P_s(tt')e^{-i\mu\omega_s} + n_s P^*_s(tt')e^{i\mu\omega_s}], \quad (11)$$

$$g(t') = \sum_s \xi^2_{sl_1}[(n_s+1)\exp(-it'\omega_s) + n_s\exp(it'\omega_s) - (2n_s+1)], \quad (12)$$

$$P_s(tt') = (1-e^{it'\omega_s})(1-e^{-it\omega_s}),$$

is derived for the scattering probability. $g^*(t)$ and $P^{\pm}_s(tt')$ are obtained

Card 3/7

Resonance scattering of...

from $g(t')$ and $P_s(tt')$ by substituting -t for t' and t' for -t, respectively. The width Γ of the ground level, defined by

$$\Gamma=\frac{2\pi}{\hbar^2}\overline{|\langle l_0|H'_{\sigma'}|l_1\rangle|^2}\rho(\Omega_{l_1 l_0}). \qquad (7),$$

4

is proportional to the intensity of the incident quantum flux. φ_1 and ψ are the wave functions of the optical impurity electrons and of the other electrons, respectively; ξ_{s1} denotes the displacement of the solvent nuclei from their equilibrium position, ω_s is the frequency of the normal oscillations of the solvent, n_s the population of the phonon field. Eq. (10) determines the resonance scattering probability for arbitrary frequency dispersion of the normal oscillations of the solution, arbitrary ξ_{s1}, and arbitrary temperature. For the excitation spectrum,

$$W(\omega_{\sigma'})=\frac{8\pi\gamma_1}{\hbar\Gamma\gamma}\omega_{\sigma'}\overline{|\langle l_0|H_{\sigma'}|l_1\rangle|^2}\left[NI_1(\omega_{\sigma'})+\sum_{j=1}^{N}I_2^j(\omega_{\sigma'})\right]. \qquad (16)$$

Card 4/7

Resonance scattering of...

results, if

$$\frac{1}{2}\sum_{s}\xi^{2}_{s l_1}(2n_s+1)\left(\frac{\omega_s}{\omega_0}\right)^2>1 \qquad (15)$$

is fulfilled. The phonon part of the excitation spectrum, defined by

$$I_1(\omega_{e'})=\mathrm{Re}\int_0^{\infty} e^{i\alpha\beta^2_f-\frac{\gamma\alpha}{2}+f(\alpha)}\,dx=$$

$$=\frac{\sqrt{\pi}}{2B}e^{-\frac{\alpha^2}{4B^2}}\left[1+\frac{3D+3C\alpha}{4B^4}-\frac{6D\alpha^2+C\alpha^3}{(2B^2)^3}+\frac{D\alpha^4}{(2B^2)^4}+\ldots\right]$$

$$\alpha=\Omega_{l_1 l_0}+A-\omega_{e'}.$$

is thus Gaussian. If (15) is not fulfilled (low heat release), the excitation spectrum is a sum of Lorentz curves. The resonance luminescence spectrum is given by

$$S^{l}(\omega_{e'})=\int_0^{\infty} dy\,\mathrm{Re}_{\alpha}\int_0^{y} dx F(x,\ y), \qquad (21)$$

Card 5/7

Resonance scattering of...

$$F(x, y)=\exp\left\{i\beta_j x-\frac{\gamma y}{2}+g(x)-4l\sum_s \xi_{sl_1}^2 \sin\frac{x\omega_s}{2}\cos\frac{\omega_s y}{2}\right\}.$$

or, if no frequency dispersion is present, by

$$S^j(\omega_{e^{ix}})=e^{-a}\sum_{l,\,m=-\infty}^{\infty} J_m^2(2a)\left(\frac{b}{c}\right)^{\frac{l}{2}}\frac{I_{|l|}(2\sqrt{bc})}{\left(\omega_{e^{ix}}-\Omega_{l,l_0}^j+\omega l-m\omega\right)^2+\frac{\gamma^2}{4}}.$$

$$b=\sum_s \xi_{sl_1}^2(n_s+1),\quad c=\sum_s \xi_{sl_1}^2 n_s,$$

with $\sum_s \xi_{sl_1}^2 = a$, $I_{|l|}$ is a Bessel function of $|l|$-th order of an imaginary argument. If (15) is not fulfilled and $\sum_s \xi_{sl_1}^2 (n_s+1)<1$,

$$S^j(\omega_{e^{ix}})=e^{-a}\sum_{\substack{\dots\tau_s\dots\\ \dots\tau_s'\dots}}\prod_s \frac{b_s^{\tau_s}c_s^{\tau_s'}}{\tau_s!\,\tau_s'!}\frac{1}{\left[\omega_{e^{ix}}-\Omega_{l,l_0}^j+\sum_s \omega_s(\tau_s-\tau_s')\right]+\frac{\gamma^2}{4}}.$$

Card 6/7

Resonance scattering of...

It is then shown that the shape of the resonance luminescence spectrum depends to a considerable extent on the shape of the irradiation spectrum. A. S. Davydov is thanked for discussions. There are 15 references: 7 Soviet and 8 non-Soviet. The four most recent references to English-language publications read as follows: Huang Kun, A. Phys. Proc. Roy. Soc. 204, 406, 1950; M. Lax. J. Chem. Phys. 20, 1752, 1952; R. Kubo, Y. Toyozawa. Progr. Theor. Phys. 13, 160, 1955; G. N. Watson. Theory of Bessel Functions, New York, 1945.

ASSOCIATION: Institut fiziki AN USSR Kiyev (Institute of Physics AS UkrSSR, Kiyev)

SUBMITTED: June 29, 1961

Card 7/7

26442
S/048/61/025/007/004/005
B108/B209

24.6410

AUTHORS: Dzyub, I. P., and Lubchenko, A. F.

TITLE: Emission, absorption, and reabsorption of gamma quanta by impurity nuclei in solid solutions

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 7, 1961, 893 - 900

TEXT: This paper was read at the XI Annual Conference on Nuclear Spectroscopy in Riga, January 25 - February 2, 1961. Emission and absorption probability of gamma-radioactive impurities are calculated in adiabatic approximation. It is assumed that the theory of the Mössbauer effect refers to translatory symmetry in the solid solution and that impurity concentration is low so that interaction between the impurity atoms is negligible. The steady state equation for the solid solution has the form $H_0\psi(\varrho,r,R) = (E - E_f)\psi(\varrho,r,R)$ (1), where E_f denotes the energy of the radiation field. The solution to this equation may be set up as $\psi(\varrho,r,R) = \Phi_m^i(\varrho)\cdot\chi(r,R)$, $\Phi_m^i(\varrho)$ being the wave function of all

Card 1/6

Emission, absorption, and...

impurity nuclei for the case where the excitation is characterized by the quantum number m and is localized to the i-th nucleus. The wave function of the system solid solution plus radiation field and the corresponding eigenvalues of energy are obtained in the form

$$\Phi_{l(n_s)(N_\varrho)} = C(\ldots N_\varrho \ldots)\,\Phi^l_m(\rho)\,\psi_l(r, R)\,|n_\varrho\rangle, \qquad (7).$$

$$E_{l(n_s)(N_\varrho)} = E_m + E_l + U^l_l(R_0) + \sum_\varrho \hbar\omega^l_\varrho\,(n_\varrho + {}^1/_2),$$

C is the wave function of the radiation field, $|n_s\rangle$ a wave function determined by the occupation number n_s; ϱ, r, and R refer to the nuclei and electrons of the impurities and to the "solvent", respectively. Assuming the matrix elements of $1_1 \rightarrow 1_i$ transitions ($i \neq 0$) to be smaller than the matrix element of the $1_1 \rightarrow 1_0$ transition (which is considered here) the authors obtain the following formula for the emission probability:

$$w^l_l = |L|^2 W^l_l = |L|^2 \frac{2}{\Gamma} R_e \int_0^\infty d\mu e^{-i\mu(E - E^l_0) - \mu\Gamma/\hbar} F(\mu), \qquad (10);$$

Card 2/6

Emission, absorption, and...

$$F(\mu)=\prod_{s}\frac{1-e^{-\hbar\omega_s^{l_1}/\theta}}{1-e^{-\hbar\omega_s^{l_1}/\theta+i\mu\hbar\left(\omega_s^{l_1}-\omega_s^{l_0}\right)}}\exp\left\{|\varkappa_{sl_1}^{j}|^2\left(1-e^{i\mu\hbar\omega_s^{l_1}}\right)-\right.$$

$$\left.-|\varkappa_{sl_1}^{j}|^2\,|e^{i\mu\hbar\omega_s^{l_1}}-1|^2\frac{1}{1-e^{-\hbar\omega_s^{l_1}/\theta+i\mu\hbar\left(\omega_s^{l_1}-\omega_s^{l_0}\right)}}\right\}, \qquad (10);$$

$$\varkappa_{sl_1}^{j}=i\left(\frac{1}{2M_j\hbar\omega_s^{l_1}}\right)^{1/2}\sum_{a=1}^{3}p_a q_{as}^{j},$$

$$R_e=\sum_{s}|\varkappa_{sl_1}^{j}|^2\hbar\omega_s^{l_1}.$$

$E_0^j = E_{m1} - E_{mo} + U_{11}^j - U_{1o}^j$; L denotes the nuclear matrix element, $\vec{p}$ the momentum of the gamma quanta. By splitting the integral in Eq. (10) into two portions with limits $[0, \omega_0]$ and $[\mu_0, \infty]$ one can find Eq. (12) on condition (11):

$$\sum_{s}|\varkappa_{sl_1}^{j}|^2\operatorname{cth}\frac{\hbar\omega_s^{l_1}}{2\theta}\left(\frac{\omega_s^{l_1}}{\omega_{\text{макс}}}\right)^2>1, \qquad (11),$$

Card 3/6

Emission, absorption, and...

$$\frac{2}{\Gamma} R_e \int_0^{t^*} d\mu e^{-\frac{1}{2}\mu(E-E_0^j)-\mu\Gamma/\hbar} F(\mu) = \frac{4}{\Gamma^2}\left[1 + \frac{C_e\alpha_e^3}{8B_e^6} + \frac{D_e\alpha_e^4}{16B_e^8} + \cdots\right]\psi(x, \eta). \quad (12)$$

Здесь

$$B_e^2 = \frac{1}{2!}\sum_{j_1}|\varkappa_{jj_1}^{j}|^2 \operatorname{cth}\frac{\hbar\omega_e^{j_1}}{2\theta}\cdot(\hbar\omega_e^{j_1})^2, \quad (12).$$

$$C_e = \frac{1}{3!}\sum_{j_1}|\varkappa_{jj_1}^{j}|^2(\hbar\omega_e^{j_1})^3,$$

$$D_e = \frac{1}{4!}\sum_{j_1}|\varkappa_{jj_1}^{j}|^2 \operatorname{cth}\frac{\hbar\omega_e^{j_1}}{2\theta}\cdot(\hbar\omega_e^{j_1})^4,$$

$$\alpha_e = E_0^j + \sum_{e_1}\hbar(\omega_{e_1}^{j_1} - \omega_{e_1}^{j_0})\,\bar{n}_{e_1} - E - R_e;$$

$$\bar{n}_e = \left[\exp\left\{\frac{\hbar\omega_e^{j_1}}{\theta}\right\} - 1\right]^{-1},$$

Card 4/6

Emission, absorption, and...

$x = \frac{2\alpha_e}{\Gamma}$; $\eta = \frac{4B_e}{\Gamma}$; $\psi(x,\eta) = \int_0^\infty dy \cos xy e^{-y-y^2\eta^2/4}$ is the function determining the shape of the emission curve of a free nucleus in consideration of the Doppler effect. Condition (11) holds in the case of great heat liberation. Similar deliberations are made for small heat liberation. Conclusions: (1) The absorption and emission curves are Gaussian at high temperatures, with a Mössbauer line superimposed. In the energy spectrum, the Mössbauer line is right of the maximum of the phonon part in the emission spectrum, and left of it in the absorption spectrum. (2) The intensity of the Mössbauer line rises sharply with decreasing temperature. (3) High-frequency vibrations play a leading part in the interaction between nuclear transition and normal vibrations. (4) In the case of small heat liberation, the absorption and emission curves are a superposition of Lorentz curves of half-width $\Gamma/2$. (5) When the impurity atoms occupy different sites in the solution and, accordingly, U_1^j depends on the position of the atoms, the shape of the Mössbauer line will be determined by the expression $\sum_j \frac{1}{(E - E_0^j)^2 + \Gamma^2/4}$. A short section of the paper is devoted to the

Card 5/6

Emission, absorption, and...

dependence of reabsorption on the thickness of the absorber and on the velocity at which absorber and emitter are relatively moving. There are 14 references: 6 Soviet-bloc and 8 non-Soviet-bloc.

ASSOCIATION: Institut fiziki Akademii nauk USSR (Physics Institute of the Academy of Sciences UkrSSR)

26443
S/048/61/025/007/005/005
B108/B209

24.6400

AUTHORS: Dzyub, I. P., and Lubchenko, A. F.

TITLE: Resonance scattering of gamma quanta from nuclei in a solid

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 7, 1961, 901 - 908

TEXT: This paper was read at the XI Annual Conference on Nuclear Spectroscopy in Riga, January 25 - February 2, 1961. The authors determined the angular distribution and the spectrum of scattered gamma quanta, as well as the excitation spectrum. It is possible to determine the frequencies of normal vibrations of the scatterer either from the spectrum of gamma scattering or from the intensity of the Mössbauer line, which appears also for other than Bragg angles. In calculating the probability of resonance scattering several resonance-scattering nuclei are assumed to be among the m atoms in an elementary cell. The states of the scatterer and of the radiation field are characterized by a set of quantum numbers $|\{n_s\}\{N_\sigma\}\rangle$, where n_s and N_σ are the occupation numbers of the phonon and photon fields, respectively. On the assumption that the virtual transitions

Card 1/5

Resonance scattering of...

are negligible, the process of resonance scattering may be considered as a sequence of transitions: $1_0\{n_s^0\}\{N_{\sigma'}\} \longrightarrow 1_1\{n_s\}\{N_{\sigma'}-1\} \longrightarrow 1_0\{n_s'\}\{N_{\sigma'}-1, N_{\sigma''}+1\}$ (1). When these three states are denoted by 0, 1, 0', and when b_0, b_1, $b_{0'}$, are the corresponding probability amplitudes, the variation of these states with time can be written down as

$$i\hbar\dot{b}_0 = \sum_{(n_s)\sigma'} b_1 \langle 0|H'|1\rangle e^{\frac{it}{\hbar}(E_0-E_1)}; \qquad (2a)$$

$$i\hbar\dot{b}_1 = b_0\langle 1|H'|0\rangle e^{\frac{it}{\hbar}(E_1-E_0)} + \sum_{(n_s')\sigma''} b_{0'}\langle 1|H'|0'\rangle e^{\frac{it}{\hbar}(E_1-E_{0'})}; \qquad (2b)$$

$$i\hbar\dot{b}_{0'} = \sum_{(n_s)} b_1\langle 0'|H'|1\rangle e^{\frac{it}{\hbar}(E_{0'}-E_1)}; \qquad (2c)$$

Card 2/5

where H' is the energy operator of the interaction between gamma quanta and nuclei, E are the energies; $\vec{\omega}_{\vec{e}'}$ denotes the wave vector of the gamma quanta. The solution of system (2) has the form $b_0(t) = \exp\{-\Gamma t/2\hbar\}$ and $b_1(t) = C(n_s)\left[\exp\left\{-\Gamma t/2\hbar + \frac{it}{\hbar}(E_1 - E_0)\right\} - \exp\{-\Gamma t/2\hbar\}\right]$; $C(n_s) = \frac{\langle 1|H'|0\rangle}{E_0 - E_1 + i\frac{(\Gamma'-\Gamma)}{2}}$,

with the initial conditions $b_0(0) = 1$. The authors obtain the following expression for the probability of resonance scattering as dependent on the frequency of the incident and the scattered light and on the scattering angle:

$$W = \frac{M}{2\pi}\sum_{nn'jj'} e^{i(\vec{\kappa}\Delta\vec{R}^{n'}-a_j-a_{j'}}\int_{-\infty}^{\infty}d\mu\int_{-\infty}^{\infty}dx\frac{e^{i\mu x}}{(\varepsilon_0+x)^2+\Gamma^2/4}\times$$

$$\times\int_0^{\infty}dt\int_0^{\infty}dt'\exp\left\{i\varepsilon_1 t' - \frac{\gamma}{2}t' + K_j(t') + \sum_s \bar{n}_s d_s\right\}\exp\left\{-i\varepsilon_1 t - \frac{\gamma}{2}t + \right.$$

$$\left. + K_{j'}(t) + \sum_s(\bar{n}_s+1)\,d_s\right\}. \qquad (8)$$

Card 3/5

$$G_j = \sum_s(\bar{n}_s + 1/2)(|P^s_{s'j}|^2 + |P^s_{s'j}|^2),$$

Resonance scattering of... ...

$$K_j(t') = \sum_s P^s_{\sigma' j} P^s_{\sigma'' j} \left((\bar{n}_s + 1) e^{-i\hbar\omega_s t'} + \bar{n}_s e^{i\hbar\omega_s t'} \right),$$

$$d_s = e^{i(\vec{f}\Delta\vec{R}^0 + i\hbar\omega_s)t} \left(P^s_{\sigma' j} - P^s_{\sigma' j} e^{-i\hbar\omega_s t'} \right) \left(P^s_{\sigma'' j'} - P^s_{\sigma'' j'} e^{i\hbar\omega_s t'} \right);$$

Notations: $\dot{M} = (N_{\sigma''} + 1) N_{\sigma'} |L_{1_1 1_0}|^2 |L'_{1_1 1_0}|^2$; $\gamma = \frac{2\pi}{\hbar}(N_{\sigma''} + 1) \overline{|L_{1_1 1_0}|^2} \varrho(E)$; $\varrho(E) = \frac{E^2}{(2\pi c)^3 \hbar^2}$; the bar on top of the matrix element $|L|^2$ denotes integration over the solid angle and summation over the polarization of the scattered gamma quanta; $\Delta\vec{R}^0 = \vec{R}^0_{n'} - \vec{R}^0_n$; $\vec{R}_n$ indicates the coordinate of the n-th scattering nucleus; $\varepsilon'_0 = \hbar(\omega_{\sigma''} - \omega_{\sigma'})$; $\varepsilon_1 = -E + \hbar\omega_{\sigma''}$; $\vec{f}$ is the wave vector of the lattice vibrations, $\bar{n}_s = (\exp(\hbar\omega_s/kT) - 1)^{-1}$. $K_{j'}(t)$ is obtained by substituting -t and j' for t' and j in $K_j(t')$. $P^s_{\sigma j} = (\vec{p}_\sigma \vec{v}_j(s))/(2M_j N \hbar\omega_j)^{1/2}$; M_j denotes the mass of the scattering nucleus, $\vec{p}_\sigma$ the momentum of gamma quanta of frequency ω_σ, $\vec{v}_j(s)$ the displacement of the j-th atom in a cell with n = 0. The excitation spectrum is found to

Card 4/5

Resonance scattering of...

consist of a phonon part with a number of clear peaks and several Mössbauer lines of the half-width $\Gamma/2$. The structure of the scattering spectrum is analogous. N. N. Bogolyubov is thanked for discussions. There are 11 references: 3 Soviet-bloc and 8 non-Soviet-bloc.

ASSOCIATION: Institut fiziki Akademii nauk USSR (Institute of Physics of the Academy of Sciences UkrSSR)

Card 5/5

S/020/61/136/001/011/037
B019/B056

AUTHORS: Dzyub, I. P. and Lubchenko, A. F.

TITLE: The Theory of the Mössbauer Effect

PERIODICAL: Doklady Akademii nauk SSSR, 1961, Vol. 136, No. 1, pp. 66-69

TEXT: In connection with the studies of emission and the absorption of γ-quanta by nuclei in a crystal lattice, much interest is displayed in considering the changes in the equilibria and the oscillation frequencies in dependence on the nuclear state. Particular importance must be attached to the criteria which determine the absorption- and intensity curves and to the criteria concerning the existence of Mössbauer lines. It is these problems that the present paper deals with. A solid is investigated, in which γ-radioactive impurity nuclei are contained, and in which the interaction between the impurity atoms may be neglected. The binding between impurity atoms of the solvent is determined by the magnetic moment of the impurity atoms which depends on the nuclear state of the impurity atom. Using adiabatic methods, it was shown that the equilibrium of the atoms of the solvents and the frequency of the normal oscillations depend

Card 1/4

on the state of the impurity nuclei. The authors give the wave function of the system nucleus + solvent + electromagnetic field in adiabatic approximation:

$$\Phi_{1 n_s N\sigma} = \Psi_1 |N_\sigma\rangle \, S_1 | n_s\rangle \qquad (1)$$

Ψ_1 are the wave function of the nucleus and the electrons in the state 1. $|n_s\rangle$ and $|N_\sigma\rangle$ are the wave functions of the lattice vibrations and of the emission field. The operator S_1^* gives different equilibria of the solvent nuclei for different nuclear states. In this case $S_1 = \exp\left\{\sum_s \xi_{s1}(b_s^+ - b_s)\right\}$ (2) holds, where ξ_{s1} is the shift of the nuclear coordinates, b_s^+ and b_s are the phonon production- and annihilation operators. Proceeding from (1), the emission of γ-quanta by an impurity atom in the transition $1_1 \rightarrow 1_0$ is investigated, and for the total emission cross section of the γ-quanta the relation $\sigma_e(E) = \frac{\Gamma^2}{4} \sigma_0 W_e(E)$ (4)

Card 2/4

is obtained, where

$$W_e(E) = \frac{2}{\Gamma}\,\mathrm{Re}\int_0^\infty \exp\left\{i\mu\,(E - E_0') - \mu\frac{\Gamma}{2} + g_e(\mu)\right\} d\mu;$$

$$E_0' = E_0 + \sum_s \bar{n}_{sl_0}(\hbar\omega_{sl_1} - \hbar\omega_{sl_0});$$

$$g_e(\mu) = \sum_s |\xi_{sl_1} + iq_{sl_1}|^2 \{(\bar{n}_{sl_0} + 1)\, e^{i\mu\hbar\omega_{sl_0}} + \bar{n}_{sl_0} e^{-i\mu\hbar\omega_{sl_0}} - 2\bar{n}_{sl_0} - 1\};$$

Here, σ_0 is the total resonance absorption cross section for γ-quanta by a free nucleus, E_0 is the energy difference between the excited and the ground state of the impurity atoms in consideration of its interaction with electrons and the solvent. The calculation of $W_e(E)$ for high and low temperatures is dealt with in great detail. From the analysis of the results obtained, the authors conclude that in consideration of the changes in the equilibrium of the nuclei and the normal frequencies of the lattice, the Mössbauer lines shift with the temperature by the quantity $\Delta E = -\sum_s \bar{n}_{sl_0}(\hbar\omega_{sl_1} - \hbar\omega_{sl_0})$. The absorption- and emission maxima are at a

distance from the Mössbauer lines, which corresponds to the recoil energy of the nucleus. The authors thank N. N. Bogolyubov and M. V. Pasechnik for discussions and for their interest. There are 9 references: 1 Soviet, 2 German, and 6 US.

ASSOCIATION: Institut fiziki Akademii nauk USSR (Institute of Physics of the Academy of Sciences of the UkrSSR)

PRESENTED: July 22, 1960, by N. N. Bogolyubov, Academician

SUBMITTED: July 6, 1960

DZYUB, I.P.; LUBCHENKO, A.F.

Scattering of γ-quanta by the nuclei of a solid. Fiz. tver. tela 3 no.8:2275-2284 Ag '61. (MIRA 14:8)

1. Institut fiziki AN USSR, Kiyev.
(Gamma rays—Scattering)
(Quantum electrodynamics)

DZYUB, I.P.; LUBCHENKO, A.F.

Emission and absorption of gamma-quanta by nuclei of solids in the presence of time-dependent external perturbation. Fiz. tver. tela 4 no.8:2081-2089 Ag '62. (MIRA 15:11)

1. Institut fiziki AN UkrSSR, Kiyev.
(Gamma rays) (Quantum theory)

37872
S/185/62/007/005/001/013
D407/D301

24.6410

AUTHORS: Dzyub, I.P., Lubchenko, A.F., and Ch'in Yün-weng

TITLE: Resonance scattering of gamma rays by impurity atoms in solids

PERIODICAL: Ukrayins'kyy fizychnyy zhurnal, v. 7, no. 5, 1962, 457 - 468

TEXT: The authors calculated the excitation and scattering spectra of gamma rays by impurity nuclei, allowance being made for changes in the frequency of normal-mode oscillations of the solid solution, and in the equilibrium positions of the impurity atoms in the case of large as well as small heat-release. It is assumed that the impurity concentration is low, so that the interaction between the impurity atoms can be neglected. In the adiabatic approximation, the wave functions and the corresponding energy values of the system are:

$$\Phi_{l\{n_s\}\{N_s\}} = \psi_l |N_s\rangle \hat{S}_l |n_s\rangle, \quad (1)$$

$$E_{l\{n_s\}\{N_s\}} = E_l + E_{\{N_s\}} + V_l'(R_0) + \sum_s \hbar\omega_s' \left(n_s + \frac{1}{2}\right) - \sum_s \hbar\omega_s' \xi_{ll}^2, \quad (2)$$

Card 1/4

Resonance scattering of gamma rays ...

where E_1 is the internal energy of the impurity atom; $E_{(N_\sigma)}$ - the energy of the radiation field; $V_1^i(R_0)$ - the potential energy of the solid solution; ω_s^1 - the frequency of the s-th normal mode; ξ_{sl} - the displacement of the atoms from the equilibrium position. An integral formula is obtained for the probability W of resonance scattering. The excitation and scattering spectra are calculated under the following assumptions: a) The spectrum of the incident gamma rays is constant in the phonon part of the absorption spectrum; b) the energy of the gamma rays is much higher than the width of the phonon part. Formulas are obtained for the excitation- and scattering spectra. It is concluded that 1) Under assumptions (a) and (b), the excitation spectrum coincides with the absorption spectrum of gamma rays. With large heat-release, the shape of the phonon part of the spectrum is close to a Gaussian curve, with a strong line of natural width (Mössbauer's line) on its longwave wing; the intensity of this line decreases fast with increasing temperature. With small heat-release, the excitation spectrum is the sum of Lorentz curves. The position of the entire spectrum changes with temperatu-

Resonance scattering of gamma rays ...

re. 2) The scattering spectrum does not generally coincide with the radiation spectrum, (under assumptions (a) and (b)). With large heat-release, the scattering spectrum coincides only at the wings with the radiation spectrum or if the viewing angle is 90°; Mössbauer's line is towards the shortwave side from the maximum of the phonon part. With small heat-release, the scattering spectrum differs little from the radiation spectrum: Mössbauer's line is present, whose intensity varies with temperature (as in the case of the excitation spectrum). If the spectrum of the incident gamma-rays has the shape of a Lorentz curve with maximum at the point $\hbar\Omega_0$ and half-width γ_0, then it is impossible to determine the scattering spectrum in the general case: Therefore the authors derived a formula for "soft" gamma-rays only (with energies of several kev.). The first term of this formula represents Mössbauer's line, whereas the other terms represent inelastic scattering of gamma-rays which is accompanied by phonon creation or annihilation. There is 1 figure and 7 references: 4 Soviet-bloc and 3 non-Soviet-bloc (including 1 translation).

Card 3/4

S/185/62/007/005/001/013
D407/D301

Resonance scattering of gamma rays ...

ASSOCIATION: Instytut fizyky AN URSR (Institute of Physics of the AS UkrRSR), Kyyiv

SUBMITTED: December 30, 1961

Card 4/4

S/020/62/145/001/010/018
B104/B102

AUTHORS: Dzyub, I. P., and Lubchenko, A. F.

TITLE: Effect of forced crystal vibrations on the spectrum of scattered γ quanta

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 145, no. 1, 1962, 73-75

TEXT: The single-phonon peaks in the spectrum of scattered γ quanta can be considerably intensified by forced crystal vibrations imparted e.g. by a quartz ultrasonic resonator. A study of the Rayleigh diffusion reveals the following: when a γ radiation with narrow energy band containing Mössbauer lines impinges on the scatterer, a Mössbauer line is observed only under a Bragg angle determinable from the conditions $\omega_\lambda - \omega_{\lambda'} = 0$ and $\vec{k}_{\lambda'} - \vec{k}_\lambda = \vec{K}$, where ω_λ is the frequency of the Mössbauer quanta and $\omega_{\lambda'}$ is the scattered-light frequency. Observations made at another angle ($\vec{k}_{\lambda'} - \vec{k}_\lambda - m\vec{q} = \vec{K}$) showed narrow bands $\omega_{\lambda'} = \omega_\lambda \pm m\omega_q$ in the spectrum of the γ quanta. ω_q is the lattice vibration frequency. The ratio between

Card 1/2

Effect of forced crystal vibrations...

relative line intensities of scattered γ quanta is $2\pi|\vec{a}|/d$ where d is the lattice constant and $\vec{a}$ the amplitude of the lattice vibrations. Academician N. N. Bogolyubov is thanked for discussions. There is 1 figure.

ASSOCIATION: Institut fiziki Akademii nauk USSR (Institute of Physics of the Academy of Sciences UkrSSR)

PRESENTED: February 19, 1962, by N. N. Bogolyubov, Academician

SUBMITTED: February 10, 1962

GORDON, Ya.Ye.; GOREL', L.F.; DZYUBA, I.P.

Observations of the moon and major planets with the meridian circle in Nikolaev. Izv.GAO 23 no.1:74-76 '62. (MIRA 16:12)

DZYUB, I.P.; LUBCHENKO, A.F.

Mössbauer effect on impurity nuclei at low temperatures. Dokl. AN SSSR 147 no.3:584-587 N '62. (MIRA 15:12)

1. Institut fiziki AN UkrSSR. Predstavleno akademikom N.N. Bogolyubovym.

(Mössbauer effect)

L 14292-63 EWT(l)/EWG(k)/EDS/EEC(b)-2 AFFTC/ASD/ESD-3 Pz-4 AT/IJP(C)

ACCESSION NR: AP3001274 S/0181/63/005/006/1577/1585

64
12
62

AUTHOR: Dzyub, I.P.

TITLE: Sum rule in the theory of exciton absorption of light

SOURCE: Fizika tverdogo tela, v. 5, no. 6, 1963, 1577-1585

TOPIC TAGS: exciton absorption, sum rule, exciton-phonon interaction, impurity centers, absorption curve

ABSTRACT: The author has sought to obtain an expression for the probability of light absorption, taking into account the exciton-photon interaction. He has found a method of determining the sum rule, that is, the moments of the exciton-absorption curve, and he has obtained values for the first four moments of the curve, investigating them for temperature dependence. Consideration of the exciton-phonon interaction gives rise to asymmetry in the absorption curve. In comparing these theoretical results with the experimental, the author found it necessary to normalize the area under the curve (of an exciton absorption band) to unity. Investigation of the 3rd-order moment for temperature dependence is especially important, for such dependence indicates that an investigated transition corresponds to a free exciton rather than to an impurity center or

Card 1/2

L 14292-63

ACCESSION NR: AP3001274

2

localized exciton. The first moment of the curve depends essentially on behavior of the curve on the "limbs," and it is hence important to examine these regions carefully. It is also essential that the investigated band does not overlap any other absorption band. "In conclusion I wish to thank A.S. Davydov for his interest in the work and for valuable discussions." Orig. art. has: 30 formulas.

ASSOCIATION: Institut fiziki AN USSR, Kiev (Institute of Physics, Academy of Sciences, Ukrainian SSR)

SUBMITTED: 05Jan63	DATE ACQ: 01Jul63	ENCL: 00
SUB CODE: PH	NO REF SOV: 006	OTHER: 011

Card 2/2

L 10228-63 EWT(1)/BDS/EEC(b)-2--AFFTC/ASD

ACCESSION NR: AP3000044 S/0056/63/044/005/1518/1524

AUTHOR: Dzyub, I. P.; Lubchenko, A. F. 56 54

TITLE: The method of temperature Green's functions in the theory of the Mossbauer effect on impurity nuclei

SOURCE: Zhurnal eksper. i teoret. fiziki, v. 44, no. 5, 1963, 1518-1524

TOPIC TAGS: Mossbauer effect, probability, temperature shift, temperature Green's functions

ABSTRACT: The probability of the Mossbauer effect for an impurity nucleus in solid solution and the temperature shift of the Mossbauer line are determined by the method of temperature Green's functions. The study of the Mossbauer effect for impurity nuclei in solid solution is of interest because it offers some pobssibility of changing the intensity of the Mossbauer line from a single radioactive nucleus by suitable choice of the crystal-solvent. The method of temperature Green's functions obviates the need for solving the dynamic problem for a substitutional solution. General equations are obtained for the

Card 1/2

L 10228-63

ACCESSION NR: AP3000044

2

probability of the Mossbauer effect and for the temperature shift of the line in terms of the parameters of the ideal solvent lattice and the mass ratio of the impurity and crystal-solvent atoms, as well as quantities characterizing the interaction of the impurity atom and the atoms of the solvent. Specific computations are made for a monatomic cubic crystal-solvent in the Debye approximation. The computed values of the probability and of the temperature shift are compared with the available experimental data. "We thank N. N. Bogolyubov for valuable comments and his interest in the work." Orig. art. has: 2 figures and 23 formulas.

ASSOCIATION: Institut fiziki Akademii nauk Ukrainskoy SSR (Institute of Physics, Academy of Sciences USSR)

SUBMITTED: 14Jul62 DATE ACQ: 12Jun63 ENCL: 00

SUB CODE: PH NR REF SOV: 006 OTHER: 008

Card 2/2

ACCESSION NR: AP4039683 S/0181/64/006/006/1866/1882

AUTHOR: Dzyub, I. P.

TITLE: Inelastic incoherent scattering of slow neutrons by unordered solid solutions

SOURCE: Fizika tverdogo tela, v. 6, no. 6, 1964, 1866-1882

TOPIC TAGS: neutron scattering, solid solution, Green function, incoherent scattering, Mössbauer effect

ABSTRACT: The author used the Green function to formulate a regular method of investigating the indicated scattering. He examined single-phonon incoherent scattering of slow neutrons by binary unordered solid solutions. An expression, represented by a series of concentrations of one of the components, was obtained for the differential effective scattering cross section of neutrons. In considering only the difference in masses of component atoms in the solution, the author made a detailed study of low concentrations. Peculiarities in the cross section of inelastic neutron scattering by nonideal crystals must be expected when the force constants change during replacement of atoms in the crystal matrix by impurity atoms. Indirect support of this is found in the characteristic temperature

Card 1/2

ACCESSION NR: AP4039683

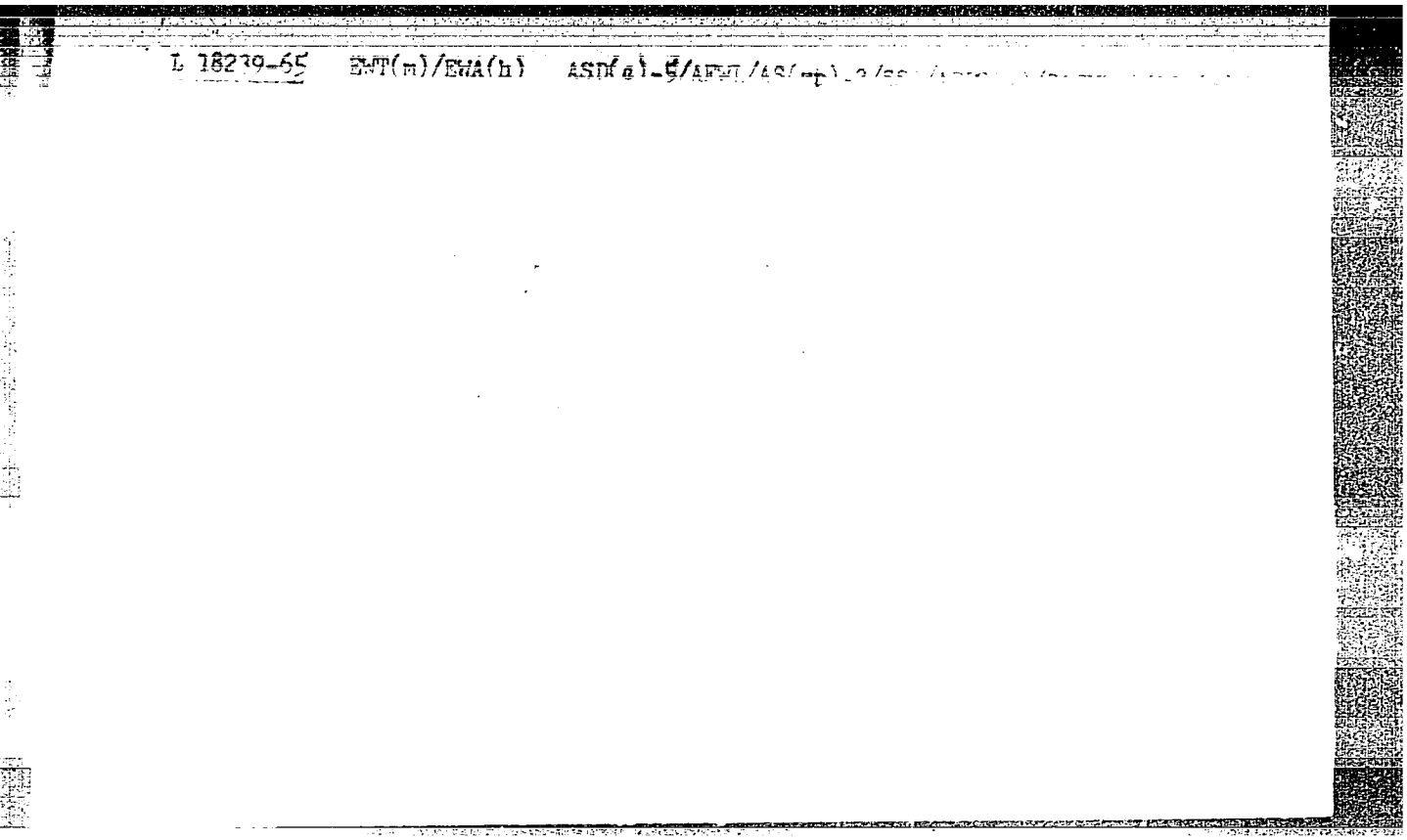
dependence of Mössbauer line intensity for impurity nuclei: when quasilocal oscillation occurs at a temperature considerably below the Debye temperature for an ideal lattice, the intensity of the Mössbauer line falls exponentially with temperature, whereas, with local oscillations, the temperature dependence of the Mössbauer line is weak, even at temperatures greater than the Debye temperature of an ideal crystal. At present, however, detailed investigation of peculiarities in the oscillation spectrum of nonideal crystals is possible only by means of inelastic scattering of slow neutrons. The best material for such a study must be vanadium with impurity atoms of tin, because coherent scattering is very weak here and the force constants remain practically unchanged during replacement of vanadium atoms by tin. Orig. art. has: 3 figures and 52 formulas.

ASSOCIATION: Institut fiziki AN UkrSSR, Kiev (Institute of Physics AN UkrSSR)

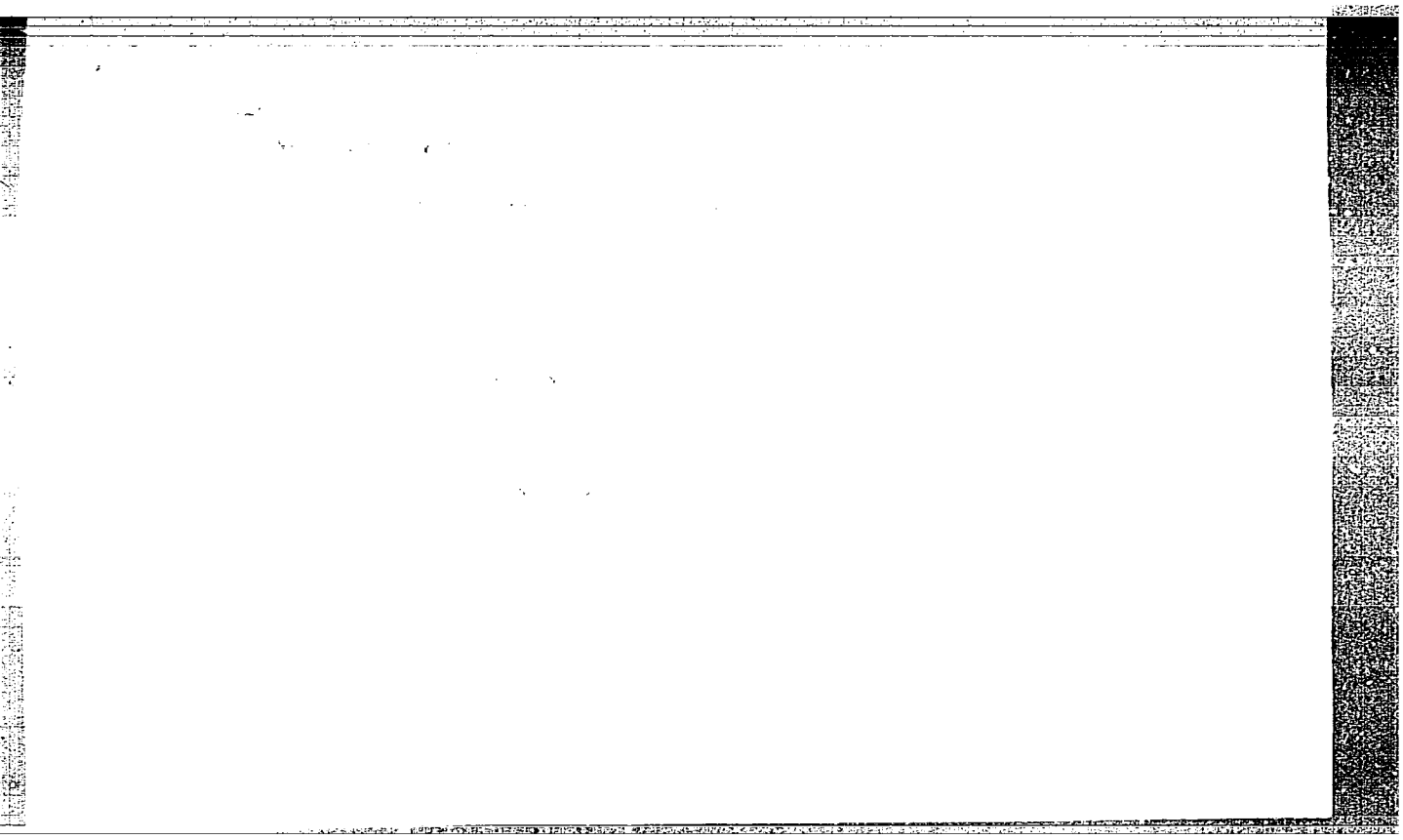
SUBMITTED: 29Oct63 ENCL: 00

SUB CODE: SS, NP NO REF SOV: 011 OTHER: 019

Card 2/2



APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000411920019-4"



APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000411920019-4"

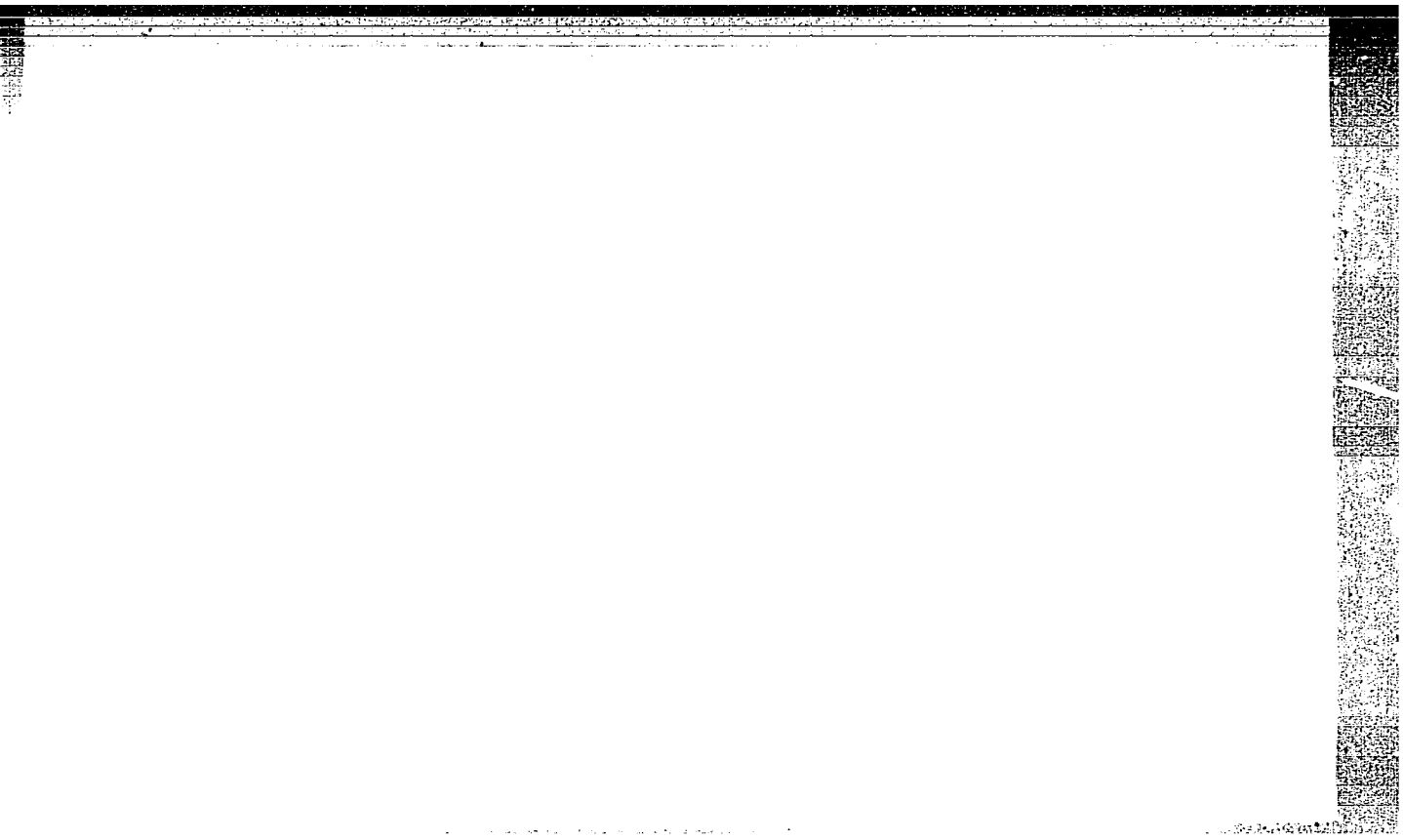
GORDON, Ya.Yo.; GOREL', L.F.; DZYUBA, I.P.

Observations of the sun, moon and major planets with the meridian circle in Nikolayev. Izv. GAO 23 no.4:91-96 '64.
(MIRA 17:9)

VERTEBNYY V.P.; DZYUB, I.P.; MAYSTRENKO, A.N. [Maistrenko, O.N.]; PASECHNIK, M.V.

Effect of close-range order in liquids on the total interaction cross sections of cold neutrons. Ukr. fiz. zhur. 9 no.6:684-686 Je '64. (MIRA 17:11)

1. Institut fiziki AN UkrSSR, Kiyev.



APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000411920019-4"

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000411920019-4"

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000411920019-4"

L 5352-66 EWT(m)/EPF(n)-2/EWA(h)
ACCESSION NR: AP5021114 UR/0056/65/049/002/0493/0499

AUTHOR: Dzyub, I. P.

16
15
B

TITLE: The role of rotational states in the scattering of slow neutrons by gas molecules

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 2, 1965, 493-499

TOPIC TAGS: neutron scattering, neutron spectrum, scattering cross section, small angle scattering, molecular physics

ABSTRACT: This research was motivated by the fact that no regular method has been proposed as yet for finding corrections to the Krieger-Nelkin formula (Phys. Rev. v. 106, 290, 1957) for the double differential cross section of neutron-molecule scattering in the region of momentum transfers where this formula gives the main properties of the spectrum of the scattered neutrons, nor is there a simple formula for the neutron spectrum in the region of low momentum transfers, where the quasi classical formula is not applicable. To this

Card 1/2

0901 1109

L 5352-66
ACCESSION NR: AP5021114

end, the author uses the Zemach-Glauber formalism (Phys. Rev. v. 101, 118 and 129, 1956) to calculate the differential cross section for the scattering of slow neutrons by gas molecules. The limits of applicability of the Krieger-Nelkin formula are examined and it is shown that this formula is not applicable either low or high momentum transfers, only at medium momentum transfers. The differential cross section for low momentum transfers is then calculated. The results agree with experimental data on small-angle scattering. Orig. art. has: 14 formulas

ASSOCIATION: Institut fiziki Akademii nauk Ukrainskoy SSR (Institute of Physics, Academy of Sciences, UkrSSR)

SUBMITTED: 20Nov64 ENCL: 00 SUB CODE: NP

NR REF SOV: 001 OTHER: 013

Card 2/2 hd

DZYUB, I.P.

Theory of the Mössbauer effect in nonideal crystals. Fiz. tver. tela 7 no.2:372-378 F '65. (MIRA 18:8)

1. Institut fiziki AN UkrSSR, Kiyev.

DZYUBA, A.

USSR/ Electronics - Radio relay-receivers

Card 1/2 Pub. 89 - 13/29

Author : Dzyuba, A.

Title : Radio receiver TPS-54 (ТП С-54)

Periodical : Radio 7, 21-24, July 1954

Abstract : A relay receiver of the "TPS-54" type, designed for installation in radio centers and at special receiving points, is described. The receiver operates on one long-wave band, one medium and four short-wave bands. The range of frequencies and the other parameters of the receiver, such as its sensitivity, selectivity and its output power, as well as the AVC and tone-quality control systems, are set forth in particular. The receiver can be fed from a 110, 127 or 200 volts line. Power consumed is not over 50 watts. Detailed description of the following items is given: 1) Input circuits and R-F amplifier; 2) Mixer and first heterodyne; 3) intermediate-frequency amplifier; and 4) Detector and A-F amplifier. The general design, data on coil winding wires,

S

Radio 7, 21-24, July 1954 (Additional Card)

Card 2/2 Pub. 89 - 13/29

Abstract : and chassis layout are featured in the article. The method of reception on two "separated" antennas is also described. Illustrations; diagrams (including a general cirucit diagram); table.

Institution : ...

Submitted : ...

DZIUBA, A. S., and GAYEL', A. G.

Afforestation of the semiarid dunes of the Caspian Sea Area. Les. khoz. 5, No 6, 1952.

06187
SOV/115-59-11-15/36

9 (2)

AUTHORS: Dzyuba, A.S., Kantor, P.B.

TITLE: A Semiconductor Thermocryostat for Checking Reference Thermometers

PERIODICAL: Izmeritel'naya tekhnika, 1959, Nr 11, pp 39-40

ABSTRACT: Checking reference thermometers in the range of + 20 to - 20°C is connected with considerable difficulties, since there are no suitable and reliable thermostats for this temperature range. A thermocryostat was developed for checking reference thermometers at the Khar'kovskiy gosudarstvennyy institut mer i izmeritel'nykh priborov (Khar'kov State Institute of Measures and Measuring Instruments). Cold is produced by a semiconductor thermopile produced by the Leningrad Sovnarkhoz. The capacity of the semiconductor thermopile is adequate to keep the temperature at - 20°C when checking four thermometers simultaneously. A temperature regulator is used, which keeps automatically the temperature at the required level. The temperature

Card 1/2

A Semiconductor Thermocryostat for Checking Reference Thermometers

transducer is a MMT thermistor which is one arm in a balanced Wheatstone bridge. The other arm is a variable resistor with a step-adjustment to 24 settings, covering the entire range from + 20 to - 20°C. Temperature changes cause resistance changes in the transducer, resulting in an unbalance of the bridge. The unbalance voltage is amplified by an a.c. amplifier by 2000 times. The signal from the amplifier is fed to the power rectifier composed of VG-10/15 germanium diodes. The rectifier feeds the thermopile thru a tank inductance. The accuracy of producing a given temperature is ± 0.02°. The prescribed temperature is reached within 25-30 minutes after the cryostat was switched on. It is planned to replace the thermopile by a larger one, whereby the temperature range is extended, or a larger number of reference thermometers can be tested. The authors describe the construction of the thermocryostat briefly. There are 1 block diagram, 1 diagram, 1 graph, and 1 Soviet reference.

S/115/62/000/005/002/006
E140/E435

AUTHORS: Iosel'son, G.L., Dzyuba, A.S.

TITLE: Thermistor temperature control

PERIODICAL: Izmeritel'naya tekhnika, no.5, 1962, 23-24

TEXT: The authors describe a conventional temperature control using a thermistor bridge and double-triode vacuum-tube amplifier, in which the temperature is maintained to within ± 0.01°C. The Soviet thermistor type MMT-4 is used. Reproducibility of temperature is ±0.02°C. There is 1 figure.

Card 1/1